

CALIBRATION STANDARD REQUIREMENT
FOR A
PORTABLE LOW TEMPERATURE CALIBRATOR
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PROCUREMENT PACKAGE

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CALIBRATION STANDARD REQUIREMENT FOR A
PORTABLE LOW TEMPERATURE CALIBRATOR

1. SCOPE

1.1 Scope. This requirement defines the mechanical, electrical, and electronic characteristics for a Portable Low Temperature Calibrator. This dry well type calibrator is intended to be used by Navy personnel in shipboard and shorebased laboratories to calibrate temperature instruments such as bi-metallic, liquid-in-glass and remote reading thermometers both in the laboratory and on-site. For the purposes of this requirement, the Portable Low Temperature Calibrator shall be referred to as the PLTC.

2. APPLICABLE DOCUMENTS

2.1 Controlling Specifications. MIL-T-28800, "Military Specification, Test Equipment for use with Electrical and Electronic Equipment, General specification for," and all documents referenced therein of the issues in effect on the date of this solicitation shall form a part of this requirement.

3. REQUIREMENTS

3.1 General. The PLTC shall conform to the Type II, Class 3, Style D requirements as specified in MIL-T-28800 for Navy shipboard and shorebased use as modified below. The use of material restricted for Navy use shall be governed by MIL-T-28800.

3.1.1 Safety. Protection from the hazards from Type III equipment, personnel safety and radiation control shall meet the requirements of MIL-T-28800, paragraphs 3.9 and 3.9.3

3.1.2 Design and Construction. The PLTC design and construction shall meet the requirements of MIL-T-28800 for Type II equipment.

3.1.3 Power Requirements. The PLTC shall operate from a source of 103.5V to 126.5V at 50 Hz and 60 Hz \pm 5% single-phase input power.

3.1.3.1 Fuses or Circuit Breakers. Fuses or circuit breakers shall be provided. If circuit breakers are used, both sides of the power source shall be automatically disconnected from the equipment in the event of excessive current. If fuses are used, only the line side of the input power line, as defined by MIL-C-28777, shall be fused. Fuses or circuit breakers shall be readily accessible.

3.1.3.2 Power Connection. The requirements for power source connections shall be in accordance with MIL-T-28800 with a 6 foot minimum (1.8 meters) length cord.

3.1.3.3 Plug-in Cabling. All plug-in cabling shall be capable of being connected and disconnected without disassembly or removal of adjacent components.

3.1.4 Dimensions and Weight. Maximum dimensions shall not exceed 18 inches (46 cm) in width, 14 inches (36 cm) in height, and 12 (31 cm) inches in depth. The PLTC weight shall not exceed 40 pounds (19 Kg).

3.1.5 Asbestos. The PLTC shall not contain or require the use of asbestos.

3.2 Environmental Requirements. The PLTC shall meet the environmental requirements for a Type II, Class 3, Style D equipment with the deviations specified below.

3.2.1 Temperature and Humidity. The PLTC shall meet the conditions below:

	<u>Temperature (°C)</u>	<u>Relative Humidity (%)</u>
Operating	10 to 30	95
	30 to 40	75
Non-operating	-30 to 70	Not Controlled

3.2.2 Altitude. The requirements of MIL-T-28800, paragraph 3.7.3 are applicable.

3.2.3 Vibration. The requirements of MIL-T-28800, paragraph 3.7.4.1 for sinusoidal vibration are applicable.

3.2.4 Shock, Mechanical. The requirements of MIL-T-28800, paragraphs 3.7.5.1 for functional shock, 3.7.5.2 for transit drop and 3.7.5.3 for bench handling are applicable.

3.2.5 Water Resistance. The drip proof requirements of MIL-T-28800, paragraph 3.7.6.3 are applicable with cover on.

3.2.6 Acoustic Noise. The requirements of MIL-T-28800, paragraph 3.7.12 are applicable.

3.2.7 Electromagnetic Compatibility. The electromagnetic compatibility requirements of MIL-T-28800 are limited to the following areas: CE01, CE03, CS01, CS02, CS06, RE01, RE02 (14 kHz to 1 Ghz), and RS03.

3.3 Reliability. Type II reliability requirements are as specified in MIL-T-28800.

3.3.1 Lithium Batteries Lithium batteries with the following characteristics are authorized for use in the equipment:

a. Lithium batteries with no more than two cells with a rated, electrical capacity of less than 200 milliampere hours per cell and if the battery is protected from other sources of electrical power by appropriate blocking diodes, fuses and/or resistors, or if there is no other source of electrical power to the unit.

b. Lithium batteries of the lithium/carbon monoflouride or lithium/maganese dioxide chemistries with no more than two cells in series with a rated electrical capacity of less than 1.25 ampere hours per cell and if the battery is protected from other sources of electrical power.

c. For equipment which carries the approval of Underwriter's Laboratories, lithium batteries of no more than two cells with a capacity of no more than 1.5 ampere hour each.

3.3.2 Calibration Interval. The PLTC shall have an 85% or greater probability of remaining within tolerances of all specifications at the end of a 12 month period.

3.4 Maintainability. The PLTC shall meet the Type II maintainability requirements as specified in MIL-T-28800 except the lowest discrete component shall be defined as a replaceable assembly. Certification time shall not exceed 2 hours.

3.5 Performance Requirements. The PLTC shall provide the following capability as specified below. Unless otherwise indicated, all specifications shall be met following a 30-minute warm-up period.

3.5.1 Temperature. The PLTC shall be capable of generating, measuring and selectively displaying the output temperature in degrees Fahrenheit (°F) and degrees Centigrade (°C). All units of temperature shall be displayed to an equivalent uncertainty based on the conversion factor for each unit of temperature.

3.5.2 Output Temperature Range. The output temperature range as measured in the temperature well shall be, as a minimum, -40 °F to +250 °F (-40 °C to +121 °C).

3.5.3 Uncertainty. The uncertainty of the output temperature, as measured in the temperature well, shall be equal to or less than ± 0.5 °F (± 0.28 °C). The uncertainty includes all effects of linearity, hysteresis, repeatability and ambient temperature.

3.5.4 Resolution. The resolution of the displayed output temperature shall be at least 0.1 over the specified range.

3.5.5 Settability. Settability is defined as the ability to set the output temperature without overshooting to an exact cardinal test point within a specified tolerance. The settability of the PLTC shall be $\pm 0.5\%$ or less of the indicated value.

3.5.6 Temperature Gradients. The temperature in the temperature well shall be uniform to within ± 0.5 °F (± 0.28 °C) of the reference temperature when measured at any point within the active or controlled area of the temperature well.

3.5.7 Temperature Stabilization Time. The output temperature shall stabilize within 30 minutes when the temperature set point is changed 60 °F (33 °C) or less from ambient.

3.5.8 Set Point Stability. The output temperature, as measured in the temperature well, at any discrete temperature setting within the specified range shall be stable to within ± 0.15 °F (± 0.08 °C) for at least one hour.

3.5.9 Temperature Runaway. The PLTC shall have a safety feature which interrupts power to the unit, except for any cooling fans, when the well temperature exceeds 260 °F (127 °C) or when the internal circuitry reaches an overheating condition.

3.6 Operating Requirements. The PLTC shall provide the following capabilities.

3.6.1 Front Panel Control Requirements. All modes and functions shall be operable using front panel controls. The locations and labeling of indicators, controls and switches shall provide for maximum clarity and easily understood operation without reference to tables, charts or flow diagrams.

3.6.1.1 Input Power Switch. There shall be an input power on-off switch located on the front panel in accordance with MIL-T-28800.

3.6.1.2 Input Power Indicator. A visual power indicator shall be provided on the front panel of the PLTC to indicate when the equipment is energized.

3.6.1.3 Front Panel Display Indicator. A visual indication shall be provided on the front panel of the PLTC to indicate when the output temperature has reached a preselected value.

3.6.1.4 Display Requirements. The PLTC shall have a alpha-numeric display that has a minimum of 40 characters.

3.6.2 Programmability. All modes and functions shall be operable via the IEEE-488.1 instrumentation bus. When operating the PLTC via remote programming, all front panel controls shall be disabled, except the on/off switch and the Remote/Local switch.

3.6.2 Temperature Setting. The PLTC shall provide a manual control for setting the output temperature in at least one degree increments. Once the temperature is set an indicator shall show when the set temperature is reached.

3.6.3 Local/Remote. The PLTC shall have a local and remote operational mode. It shall be either manually or remotely programmable selectable according to paragraph 3.6.2. When changing modes, all parameter values shall remain unchanged.

3.6.3.1 Remote Calibration and Standardization. The PLTC shall be capable of being calibrated and/or standardized remotely via the IEEE interface.

3.6.4 IEEE Interface. The PLTC shall have an IEEE-488.1 interface connector with the following capabilities: SH1, AH1, T6, L4, SR1, RL1, DT1. Serial poll capability shall be provided

3.7 Printer. The PLTC shall have an on-board dot matrix printer that utilizes standard adding machine paper. One replacement printer cartridge shall be included.

3.8 Keyboard. The PLTC shall provide a keyboard for setting the desired output temperature in at least one degree increments throughout the specified range. Once the temperature is set, the display shall show when the set temperature is reached.

3.9 Dry Well Interface Requirements. The PLTC shall contain a dry temperature well that will accept the probes of the thermometers specified in Section 3.10. The physical interface shall be such that the heat loss between the PLTC and thermometer does not degrade the accuracy of the PLTC. Thermal conductive liquid or grease shall not be used as a thermal transfer material.

3.10 Compatibility. The PLTC shall meet the following compatibility requirements.

3.10.1 Temperature Sensors. The PLTC shall be capable of calibrating the thermometers specified in Federal Specification GG-T-321 and Military Specifications MIL-T-940, MIL-T-17244 and MIL-T-19646 that have full scale ranges within the output temperature range of the PLTC.

3.10.2 Calibration Standard. The PLTC shall be physically compatible with the Navy authorized temperature transfer standard,

the Rosemount Model 162CE Platinum Resistance Thermometer and the Instrulab Model 4202B-13-15 Temperature Indicator.

3.10.4 Instrument Calibration Procedures. The PLTC shall be compatible with all NAVAIR 17-20(Series) Instrument Calibration Procedures in effect on the date of this solicitation which require a dry well temperature calibration standard with a accuracy of ± 0.5 °F (± 0.28 °C) or better and within the temperature range specified in 3.5.2 for calibrating bi-metallic, liquid-in-glass and remote reading thermometers.

3.11 Enclosure. The PLTC shall be installed in one enclosure. The enclosure shall meet the Type II, Class 3, Style D requirements on MIL-T-28800, except the external power connection shall be on the front panel.

3.12 Accessories. The following accessories shall be provided with each PLTC.

3.12.1 Power Cable. One power cable with minimum length of 6 feet (1.8 meters).

3.12.2 Adapter Set. The PLTC shall contain all adapters required to accommodate the thermometers specified in Section 3.12. The adapter set shall also include adapters with bore diameters of 1/4 inches, 3/8 inches, 7/16 inches, 9/16 inches. All adapters shall be permanently marked with a unique number or letter.

3.12.3 Adapter Handling Tool. One adapter handling tool to handle hot adapters.

3.12.4 Caliper. One vernier caliper (for measuring adapter and thermometer diameters).

3.12.5 Continuity Tester. One continuity tester (for checking operation of thermal switches).

3.12.6 Storage. All accessories and the Operation and Maintenance Manual shall be stored in the enclosure or enclosure cover.

3.13 Manual. At least two copies of an operation and maintenance manual shall be provided. The manual shall meet the requirements of MIL-M-7298.

3.13.1 Calibration Procedure. A calibration procedure in accordance with MIL-M-38793 shall be provided.

4. QUALITY ASSURANCE PROVISIONS

4.1 General. The PLTC shall be tested in accordance with the bid sample tests specified in MIL-T-28800 for Type II, Class 3, Style D equipment. The bid sample tests shall include those tests specified in MIL-T-28800 except where modified below as well as the tests specified in the following paragraphs.

4.2 Group A Tests. Group A tests shall include the tests specified in MIL-T-28800 as modified below.

4.2.1 Preoperational Inspection. The preoperational inspection shall be in accordance with MIL-T-28800 and shall include a verification of the condition and acceptability of the accessories specified in 3.10.

4.2.2 Level A Performance. Level A performance tests of MIL-T-28800 paragraph 4.5.3.2 are applicable.

4.3 Group C Tests. Group C tests shall include the tests specified in MIL-T-28800 as modified in 4.4.1 through 4.4.5 below.

4.3.1 Temperature and Humidity (T/H). Perform a T/H test in accordance with MIL-T-28800 for Class 3 equipment as modified by the operating and non-operating conditions specified in 3.2.2 of this specification. Verify that the PLTC meets the performance requirements of the T/H testing.

4.3.2 Altitude. MIL-T-28800, paragraph 4.5.5.2 is applicable.

4.3.3 Vibration. MIL-T-28800, paragraph 4.5.5.3.1 sinusoidal vibration test is applicable.

4.3.4 Transit Drop. Perform a transit drop test in accordance with MIL-T-28800 for Type II, Style C equipment using a drop height of 6 inches (15 cm). Verify that the PLTC meets the performance requirements of the operation test after being subjected to the transit drops.

4.3.5 Water Resistance. Perform a drip-proof test in accordance with MIL-T-28800 for Type II, Style C equipment. Verify that the PLTC meets the performance requirements of the operation test after being subjected to the drip-proof test.

4.3.6 Electrical Power. Perform the electrical power tests in accordance with MIL-T-28800 for Type II equipment. Verify that the PLTC meets the performance requirements specified.

4.3.7 Group C Verification. Perform the Group C verification tests in accordance with MIL-T-28800. Group C verifications tests shall include Level A performance tests specified in 4.2.3.

4.4 Group D Tests. Group D tests shall include the tests specified in MIL-T-28800 as modified below.

4.4.1 EMI. Perform EMI tests in accordance with MIL-T-28800 for Type II, Class 3 equipment as modified by the compatibility requirements of 3.2.7.

4.4.2 Group D Verification. Perform the Group D verification tests in accordance with MIL-T-28800. Group D verification tests shall include Level A performance tests specified in 4.2.3.

4.6 Group E Tests. Group E tests shall include the tests specified in MIL-T-28800 as modified below.

4.6.1 Marking and Identification. Verify that the PLTC and all component parts conform to the marking and identification requirements of MIL-T-28800.

4.7 Group F Tests. Group F tests shall include the tests specified in MIL-T-28800 as modified below.

4.7.1 Reliability. Documentation shall be submitted with the bid samples to show how the reliability characteristics of the PLTC comply with MIL-T-28800. Verify that the PLTC conforms to the reliability requirements of MIL-T-28800.